# Simulation and gaming in natural resource management

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Author-produced version of the article published in SIMULATION & GAMING, Vol. 38 No. 2, June 2007 181-184
Original publication available at SAGE Publications - http://sag.sagepub.com/
DOI: 10.1177/1046878107300657

**Guest editorial:**

# Simulation and Gaming in Natural Resource Management

The idea of this special issue on the contributions of simulation and gaming to natural resource management issues sprang from discussion between Olivier Barreteau and David Crookall in 2004 before and during ISAGA'04 in Munich. Its suitability was confirmed through discussion with several participants during the conference. This issue has been some time in production, and we are grateful to David Crookall for his continued advice and patience throughout.

This special issue gathers experiments where simulation and gaming techniques have significantly contributed to improving natural resource management. Several papers show that the use of simulation games may foster favourable conditions for collective negotiations (Barnaud et al., Dray et al., Camargo et al.). Other papers demonstrate the benefits of this approach in raising environmental awareness among students or local communities (Mathevet et al.; Witteveen and Enserink; Depigny and Michelin). Bots and van Daalen conclude this series of examples with a literature review of several gaming experiments that leads to a tentative typology based on targeted NRM policies. The table below lists the main characteristics of the papers included in this special issue according to their NRM objective, simulated resources, and simulated users. Names given to the simulation games are only indicative.

| Paper | Game(s) | NRM objective | Simulated resources | Simulated users |
|---|---|---|---|---|
| Barnaud et al. | MAE SALAEP | Watershed management | Water<br>Land<br>Crop | Farmer |
| Barreteau & Abrami | PIEPLUE | River basin management | Water | Farmer |
| Camargo et al. | JOGOMAN | Water management in peri-urban areas | Water<br>Land | Architect<br>Entrepreneur<br>Public officer |
| Depigny & Michelin | SHRUB BATTLE | Landscape ecology | Vegetation | Herder |
| Dray et al. | ATOLLGAME | Freshwater lenses management | Water<br>Land | Landowner<br>Public officer |
| Krolikowska et al. | KARKONOSZE | Nature conservation vs economic development | Vegetation<br>Wildlife | Local community,<br>Skiing industry,<br>Forestry Dept<br>Ecologist |
| Lankford & Watson | RIVER BASIN GAME | River basin management | Water | Farmer |
| Martin et al. | Microworld Green-Legged Hens | Eco-agriculture | Land | Farmer |
| Mathevet et al. | BUTORSTAR | Wetland management | Water<br>Wildlife | Herder<br>Reed harvester<br>Waterfowl hunter<br>Scientist |
| Qudrat-Ullah | FISHBANK-ILE | Fisheries management | Fish | Manager |
| Witteveen & Enserink | VPA-KERALA | Coastal zone management | Land<br>Water<br>Fish | Farmer<br>Fisherman<br>Craftsman<br>Sand miner<br>Public officer |

**Krolikowska et al.** create a simulation game on mountainous areas development to teach students about potential sources of conflict. Students play the roles of stakeholders they previously interviewed. This method helps students to grasp the diversity of legitimate viewpoints, and the difficulty of making them coexist. Discussions with stakeholders directly about the simulation can lead negotiation meetings to re-convene, but cannot halt the on-going conflicts.

In lower Silesia, **Martin et al.** use the paradigm of flight simulator. They develop and implement computer-assisted gaming sessions to help farmers to explore the opportunities offered by a local '*ecological product*' industry. The farmers actively contribute to this process by suggesting improvements to the simulation tool and scenarios. The authors acknowledge the fact that the whole process effectively supported the creation of collaborative partnership between farmers, NGOs, and local authorities.

When natural vegetation dynamics interfere with farming practices changing landscape patterns are often difficult to depict, explain and understand. In this context, both papers from **Mathevet et al.** and **Dépigny & Michelin** illustrate the usefulness of gaming sessions to raise the awareness of participants whether they are real stakeholders or remote students. From an educational perspective, these two papers demonstrate a double benefit of organizing gaming sessions: not only are the players gaining a better understanding of the ecological processes, but they are also realizing how crucial the negotiation process is in such complex situations.

**Witteveen & Enserink** use video filming techniques to create an interactive educational tool - Visual Problem Appraisal (VPA) - on integrated coastal management in Kerala, southern India. First, students are given a fictive mission and initial knowledge of the context by watching a documentary. Then, they get the opportunity to perform 'virtual interviews' with local stakeholders based on pre-recorded material. Finally, they explore the use of VPA directly with stakeholders and they discover that the mere projection of these filmed interviews succeed in enhancing social learning and collective management principles.

**Barreteau & Abrami** use a hybrid tool aimed at exploring new dimensions of water sharing in an irrigated part of a river basin. First, they design a test-bed which makes explicit the diversity of interactions among water users. It also provides an opportunity to establish a debate on water sharing amidst overall water use. The authors argue that the hybrid use of the Role Playing Game (RPG) and computer simulation facilitates the exploration of a large range of time scales.

**Qudrat-Ullah** takes on traditional experimental economics settings and proposes a formal analytical approach to evaluate the benefit of collective debriefing during a gaming experience. The author applies his methodology to a theoretical fisheries problem derived from the FISHBANK model (Meadows, 2001). As a matter of fact, players who benefited from knowledge exchanges tend to perform better than those relying on their own judgement.

**Barnaud et al.** describe a series of simulation games involving members of a highland community in Northern Thailand. The authors develop a sequence of three different simulation games representing the same area. Each one deals with a specific issue brought up during the previous gaming session. The benefit of this iterative approach is to allow stakeholders to deepen their understanding of the dynamics of their socio-ecological system, while refining the questions they want to address collectively.

**Lankford & Watson** describe a rather original game, based on a physical model, using marbles to represent water and a board on a slope to represent the river basin. Players use small sticks to derive marbles for their own use like irrigators would do. This setting is then used to explore various socio-economic scenarios, leading to a discussion on new institutional arrangements. On the basis of several experiments in Africa, the authors discuss the ability of this metaphoric game to generate new knowledge and to influence actual management.

Based on a comparison between five gaming experiences in Brazil, **Camargo et al.** analyze the educational value of the simulated negotiation over water management in peri-urban environments. The authors point out that games provide a useful learning environment to construct and share understanding about concepts, procedures and behavioural patterns. To do so, simulation games must find a balance between simplicity and realism.

**Dray et al.** apply simulation games in the context of freshwater management in small islands of the Pacific. The authors develop a continuous design methodology from knowledge elicitation techniques to computer-assisted role playing games. Despite the successful implementation of the approach, leading to management scenarios, the authors emphasize the importance of the game's meta-environment when applied to conflict resolution situations.

Based on a review of literature on gaming experiments, **Bots & van Daalen** propose a 6-dimension typology of functions associated with games in a policy-oriented context. Each dimension emphasizes specific features of a game. The authors insist notably on the function of '*backstage thought*' support (laboratory, design studio, practice ring), as well as virtual communication support for collective decision making (negotiation table, consultation forum, parliament).

Considering the conclusions drawn by the articles in this special issue of *Simulation and Gaming*, we believe that the use of simulation games for tackling NRM issues is characterized by a win-win situation. Simulation games provide NRM situations with useful approaches to support and understand collective decision-making processes. They evidently enhance collective communication and social learning in a domain where more traditional approaches cannot match the complexity and multiplicity of viewpoints.

Conversely, issues tackled by NRM are pushing forward the practice of simulation games. NRM researchers using computer simulations often need to represent complex interactions between biophysical and social dynamics. They are therefore searching for innovative ways to use various media. NRM issues are very conflictual at times and some stakeholders are reluctant at first to enter constructive dialogue. This presents a demand for simulation game designers to create smart settings which ensure social engagement. Finally, NRM contexts offer fantastic opportunities for simulation games to explore innovative avenues in order to build a bridge between science and society.

We hope that readers will enjoy reading about these experiments that don't fall into the usual topics covered by Simulation & Gaming.

--- Olivier Barreteau, Christophe Le Page and Pascal Perez
*Guest Editors*